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Morrell's Fire Engine, Deep Well, and Force Pump.

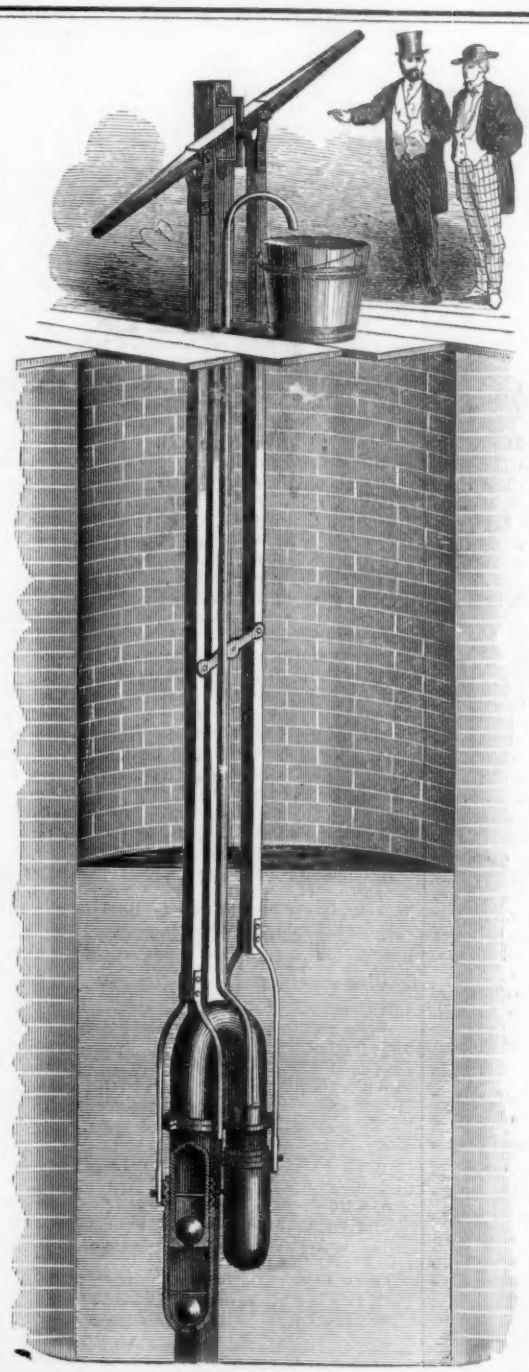
Improving the art of raising water has been the study of civilized man since the earliest ages. As an aid in domestic, agricultural, mining, manufacturing, and other purposes, hydraulic machines of nearly every conceivable pattern and device have been employed. In fact, the art of raising water has ever been closely connected with the progress of man in civilization—so much so indeed, that the state of this art, among a people, may be taken as an index of their position on the scale of refinement. The earliest pump known to history is the leather cone box pump, which is a German invention.

Now let us turn to the last modern invention in this line and we have the famous Morrell pump, which the accompanying engraving will give to the intelligent reader a clear idea of. It will be observed that all the valves are globular, so as to never wear uneven, and all the movable or working parts are constantly below the water and out of reach of frost. We proceed to give the following testimony of its advantages.

"This pump is acknowledged by all mechanics who have seen it, to be, in its construction, the most simple, reliable, and durable pump now in use. They are made of iron or brass, as desired. The valves are solid rubber balls, which, as arranged in this pump, are as nearly indestructible as anything we can use. It is a splendid fire engine, and each pump is so constructed that a hose can be attached without delay. It works perfectly in any depth of well. It cannot freeze in winter. There is no suction valve or packing to get out of order. It is more durable than any other pump now in use. The prompt action of these pumps, their simplicity of construction, durability and reliability, give them a character of excellence unequalled by any other force pump now in use. They are the best pumps for railroad stations, factories, elevators, tanneries, breweries, manufacturing establishments generally, for steamboats and ships use, for hotels, and it is what all farmers and stock raisers need."

This pump is a western invention, patented by Jas. A. Morrell of Chicago, October 29, 1867. Over 2000 have been manufactured and sold in that vicinity during the past year.

For further particulars apply to Morrell Pump Company, office 73 Beekman street, New York city.



MORRELL'S FIRE ENGINE, DEEP WELL, AND FORCE PUMP.

Water Filters.

It is essential that water employed for drinking and for culinary purposes should possess a high degree of purity, as without this it is liable to prove the source of serious detriment to health. The water of mountain streams and isolated springs is generally the best adapted for the purposes indicated, as its main impurities are simply carbonic acid and a few comparatively harmless mineral substances in solution. On the other hand river water is more commonly charged with more or less organic matter, more injurious in a sanitary point of view than any other; while rain-water, probably in reality more pure than that from any other source, always contains an appreciable quantity of organisms, capable of putrescence and derived from the atmosphere, in addition to which, in cities, it is further contaminated with salts of lead and zinc from the roof and gutters from which it passes to the cisterns. As water from large or small rivers constitute the main supply of nearly all towns and cities, and rain-water is also to a considerable degree, its purification from deleterious substannes becomes a matter of great practical importance, and a brief sketch of some of the common and more improved forms of portable filters, designed for the use of travelers, families, etc., may not be without interest to many, our description being those of devices manufacured in France, and worthy of more extended adoption than they have yet received.

The process of filtration involves two separate functions—one the mechanical removal of impurities held in suspension; the other the removal by absorption or neutralization of matters held in solution. The former is most easily done either by some closely-felted material or by a kind of porous artificial stone. The latter may be most effectually secured by the use of some form of carbon. A French inventor claims to have discovered a material in which both of these functions may be carried out, but its composition is not made known.

One of the simplest and most convenient forms of filters is that termed the funnel filter, and composed of a slightly funnel-shaped body having the filtering medium placed in its lower portion, and provided with a central downwardly projecting tubular stem. By simply filling the body with the liquid to be filtered, and inserting the stem in the neck of a bottle or other vessel, the liquid is caused to pass slowly into the latter in a purified condition. Another very simple form, more particually intended for travelers, soldiers, etc., is the pocket filter, consisting of an india rubber tube fitted with a mouth-piece at one end and a porous stone at the other. It is used by placing the stone in the water and sucking upon the tube, and is of course used mostly

in the act of drinking direct from water sources: although it is capable, by the exercise of a little skill, of use as a kind of siphon filter. These devices are now well known in this country, and can justly lay claim to the merits of cheapness, compactness, utility. The siphon filter is similar to that last mentioned, except that the stone is supported upon legs by which its entire surface is made immediately accessible to the water, and the tube has a stop-cock at its outer end by which the flow of the liquid through the filter may be stopped It is used by immersing the stone in the liquid to be filtered and extending the outer end of the tube to a level sufficiently below that of the stone to issue the flow of the latter through the tube, and, of course, through the stone, on the well known principle of the siphon. A modification of this class of filters is termed the "fountian filter," and is formed by placing the stone within a water receptacle And causing the tube to terminate in the outlet cock, the water being thus filtered in its passage from the receptacle. This purification of water, as it is drawn off for use, would be highly desirable with reference to the ordinary water-supply of dwellings in cities, but in such case the desired result would be best obtained by the employment of "pressure filters," in which the water is caused to pass through the filtering medium by the force of its own current. It has been proposed in this country to arrange such filters between the outlet cocks and their distributing pipes, the filtering material being so arranged within the metalic case of the apparatus as to be readily reversed, in order that in the event of becoming surcharged with impurities it may be washed out and cleaned by allowing the water to pass through in an opposite direction.—*American Artisan*

Welding Copper.

The difficulty experienced in welding copper has been caused, as is well known, from the formation of an infusible oxide; Mr. Philip Rust, Inspector of Salt Mines in Bavaria, has, therefore, turned his attention to the finding of a flux which shall lead to the formation of an oxide, which would be removed as a fusible slag. The use of microcosmic salt on the surfaces to be united succeeded perfectly, but was too expensive; he, therefore, substituted a mixture of one part of the salt with two parts of boracic acid, which answered the same purpose as the original compound, with the exception that the slag formed was not quite as fusible as before. This welding powder should be strewn on the surface of the copper at a red heat; the pieces should then be heated up to a full cherry-red or yellow heat, and brought immediately under the hammer, when they may be as readily welded as iron itself. For instance, it is possible to weld together a small rod of copper which has been broken; the ends should be beveled, laid on one another, sized by a pair of tongs, and placed together with the latter in the fire and heated; the welding powder should then be strewn on the end, which, after a further heating, may be welded so soundly as to bend and stretch as if they had never been broken. Mr. Rust has welded strips of copper plate, and drawn them into a rod without difficulty. To ensure success, the greatest care must be taken that no charcoal or other solid carbon comes into contact with the points to be welded, as otherwise phosphide of copper would be formed, which would cover the surface of the copper, and effectually prevent a weld. In this case it is only by careful treatment in an oxidising fire and plentiful application of the welding power that the copper can again be welded. It is, therefore, advisable to heat the copper in a gas flame. As copper is a much softer metal than iron, it is much softer at the required heat than the latter at its welding heat, it must be carefully hammered with a very light hammer, or better, by a mallet, and so shaped as to resist the blows as far as possible.—*London Mining Journal.*

Fraud in the Great Central Gas Consumers Company of London.—In presenting their thirty-sixth report to the shareholders, the directors have the deep mortification of submitting a statement of frauds of a startling character, which have for a series of years been systematically carried on in the office of the company, as far as can be ascertained, by one of their clerks, Benjamin Higgs; and they regret to be obliged to add that the inquiries instituted have brought to light a total neglect of duty by others, from whom, as old and trusted officers, the directors had every right to expect faithful service. It will be seen by the auditor's report, the result of a thorough investigation, only completed yesterday, that the large sum of £71,214 2s. ($356,070 24) has been stolen in the manner described. That this could have been effected is as astounding to the directors as it must necessarily be to the proprietors.—*London Jour. of Gaslighting, April* 27.

Chemical Repertory.--No. 9.

JUNE 16, 1869.

12. Aluminium.

Forty years ago a few grains of this metal were prepared by Professor Woehler, at the University of Goettingen. He sealed the little pellets in a glass tube, and it was not thought that the metal could ever have any useful applications. The discovery rested dormant for thirty years, when attention was called to it by the eminent French chemist Deville.

The circumstances were as follows: The Emperor Napoleon, anxious to display some interest in scientific matters, appropriated 50,000 francs to defray the expenses of researches into the properties and cases of aluminium, and Henry St. Claire Deville was authorized to make the experiments. We happened to be in Paris when this took place, and were one day invited by Professor Deville to witness the preparation of the metal in the presence of the Minister of War, Professor Dumas, and of other celebrities. Deville, who is the most genial, popular, and successful of the French chemists, received his guests with great cordiality, and explained, in the clearest possible manner, every step of the operation. He extracted a silver-white metal from a lump of clay. The way he did it was very simple. Chlorine gas was passed over heated clay mixed with charcoal, and the chloride of aluminium thus produced was driven over melted sodium. The chlorine first extracted the metal from the clay, and was in turn decomposed by the sodium. In chemistry, might makes right, and every compound can be attacked and forced to capitulate, if the proper weapons are brought to bear upon it. The aluminium was first seduced from its strong citadel of clay by the chlorine, and was then attacked and captured by the sodium.

The experiments, in a small way, having proved successful, extensive works were established in the neighborhood of Paris, where aluminium was manufactured on a large scale. At the Paris Exhibition of 1867, Mr. Paul Morin exhibited numerous objects manufactured from pure aluminium and from its alloys.

The specific gravity of the metal is 2·67. It is tin-white, fusible at a red heat, brilliant, malleable, ductile, sonorous, an excellent conductor of electricity, insoluble in dilute sulphuric acid, and in concentrated nitric acid; easily soluble in hydrochloric acid and the alkalies. It does not decompose water, as was at first supposed, and does not oxidize materially in the air.

Professor Henry Wurtz of New York has recently discovered that if it be rubbed with mercury it oxidizes so rapidly as to produce great heat. It was at first found impossible to solder the metal, but this difficulty has been at length overcome. When fused with iron it forms a crystalline mass not malleable. Mixed with copper in the proportions of ten parts of aluminium and ninety parts of copper, it forms a beautiful alloy, possessed of the color and many of the properties of gold. This alloy is called aluminium bronze, and is now employed for the manufacture of watch-cases, watch chains, and imitation jewelry. Nearly all the aluminium now manufactured is converted into the above alloy, and the interest in it, which at one time began to flag, is once more revived, and several new establishments have arisen for its manufacture. Four hundred pounds a month are now manufactured in France, and sold at $12 per pound. It is largely produced in England.

Aluminium is one of the most abundant metals on the earth. It is found in brick and porcelain clay, in feldspar, in cryolite, in granite, in slate rocks, in the ruby and sapphire. When iron rusts it turns to a red powder, and can be washed away. When aluminium rusts, or is fused at a great heat among the crystalline rocks, it gives to us the precious stones called the ruby and sapphire.

As soon as the metal is required in large quantities, some method will be devised for producing it at a cheap rate, and when that time arrives we shall not have to fit out expeditions to go and search for the ore in remote regions, but we can dig for it under our feet, nearly everywhere, and make a mine of every stone quarry. The beautiful tone of the metal has suggested its use in the manufacture of bells, and a successful application of it for this purpose has been made.

Aluminium has been employed by chemists as a reducing agent in the preparation of some of the rare metals, and we may have to record a more extensive use of it for this purpose.

There have recently been introduced into use in Paris two new alloys of aluminium. The first is called aluminium silver, or third silver (tiers argent), and is composed of one-third silver and two thirds aluminium. It is chiefly employed for forks, spoons, and tea service, and is harder than silver and more easily engraved. The second is called minargent, and is made of one hundred parts copper, seventy parts nickel, five parts antimony, and two parts aluminium. It is a very beautiful, permanent, and brilliant alloy, capable of replacing silver for many purposes.

It must be acknowledged that the application of aluminium in the arts are not so numerous as was at first predicted, and its manufacture, as compared with other metals, can at the present time hardly be called a metallurgical one. The metal is so light that a little of it will go a great way. A cubic foot of it weighs 168 pounds, whereas a cubic foot of gold weighs 1200 pounds, and silver weighs 656 pounds, iron 450 pounds, and even granite weighs 186 pounds to the cubic foot. If the price of it were the same as that of silver, it would still be much cheaper, as only one-fifth as much would be required to cover the same space.

So abundant is this metal, that it is safe to predict that the day is not far distant when our houses may be built of it instead of bricks, and we shall use it for many purposes now unknown.—[Prof. Joy in the *New World.*

CHEMICAL *EXCERPTA.*

[*Ann. d. Chem. v. Pharm., March* 1869.]

On Gummic Acid and some of its Combinations.—Gummic acid was first discovered by Reichardt in 1863, and its name derived from the fact that this substance (the acid), accompanied by a gum-like matter, is formed when oxide of copper in alkaline solution is acting upon grape sugar. The anhydrous acid has the formula—$C_6 H_5 O_{10}$; the hydrate is expressed by—

$$C_6 H_5 O_{10} + 3HO + 6aq.$$

Neutral, or alkaline ammoniacal solutions of the acid are precipitated by chloride of calcium solution. Lime water yields directly a precipitate. Chloride of iron does not precipitate the acid, or its salts, but does so on addition of alcohol; solutions of platinum and silver become reduced to metal when in contact with the acid. The acid combines with bases and oxides of metals to form salts.

[*Journal Prack. Chem.*, 1869.]

Analysis of Ripe Grapes.—Dr. Classen has done good service to science, as well as technology, by supplying us with these analyses; the grapes, three different kinds, grown in the neighborhood of Kreuznach, were bought promiscuously in the market place there: 1000 grammes of fruit yielded (1) 577, (2) 1032 grammes, juice; this consisted in 10,000 parts of solid substance dried at 100° C.—(1) 1644, (2) 1897, (3) 2046; grape sugar—1499, 1624, 1740; free acid—72, 68, ⅛8; ash—27·83, 30·95, 40·08. The ash contains, as might be expected, a large proportion of potassa and phosphoric acid as the chief constituents, and beside chlorine, sulphuric acid, lime, silica, and small quantities of magnesia, and oxides of iron and manganese

Notes on the Manufacture of Soap.—It is a well-known fact that, by an indirect process, a potassa soap may be converted into a soda soap; this is done by adding to a boiling solution of patassa soap a very concentrated solution of common salt; and it is generally taken for granted that, if enough of the latter has been added, the potassa is converted at least chiefly into soda, while chloride of potassium is formed. Neither in chemical nor in technological works the question *how much* of the potassa is substituted by soda has been answered; hence it occurred to Dr Oudemans to ascertain this point, he having a good opportunity to do this by being acquainted with the proprietors of large soap-works. Without entering into the full details of his published paper on the subject, we quote the results obtained by him, which are these; By the process as executed on a large scale, and yielding excellent produce, only a little more than half, to wit 537 per cent. of potassa is replaced by soda, while 46·3 per cent of potassa are left along with the other alkali combined with fatty acids in the curd soap.

On the Alloy of Iron and Zinc.—It is a well-known fact that iron is dissolved by molten zinc, but nowhere is any definite alloy of these metals described, nor is it also stated how much iron is dissolved by zinc. Dr. Oudemans, Jun., obtained for analysis a piece of metal which had been formed in an iron vessel wherein zinc had been fused for several weeks continuelly; this metal was found deposited at the bottom of the vessels and became an impediment to the melting operation, in consequence of the relative infusibility of the alloy. In physical aspect this latter was of very much whiter color, and entirely different crystalline structure than zinc; the alloy dissolved very readily and briskly in dilute sulphuric or hydrochloric acid, and was found, on analysis, to contain 4·6 per cent of iron. Taking for granted that this alloy is a definite compound of the two constituent metals, its formula would be

$$FeZn_{36} \text{ (Fe=56; Zn 32·75).}$$

[*Moniteur de l'Indre.* 1869.]

Obtaining Coke Quite Free from Sulphur.—The coke made in the usual manner is placed in an apparatus wherein it is heated at a temperature of about 300 deg. C., and simultaneously submitted to the action of a strong current of atmospheric air compressed to between

two and three atmospheres (40 to 45 lbs. to the square inch). By this means the sulphur is converted into sulphurous acid, and that gas removed by the strong current of air. Analysis of coke before and after having been submitted to this process proves:—(*a*) Not a trace of sulphur is left in any form in the coke submitted to the described treatment; (*b*) all the iron previously existing in the coke as sulphide has been converted into peroxide; (*c*) the calorific power of the desulphurized coke has become greatly increased, and is at least one-fourth more than that of ordinary coke: (*d*) experiments conducted on the large scale at iron works have proved that the coke treated as described produces iron as good in quality as that obtained with wood charcoal.

[*Chem. Centralbl.*, 1869.]

Results of Analysis of Compressed Peat from Switzerland.—The air-dried substance contained in one hundred parts—Water, 23·17; carbon, 40·09; hydrogen, 4·53, oxygen, 21·50; nitrogen, 2·84. The material submitted to elementary organic analysis had been dried at 120 deg. C. The ash contained chiefly sulphuric acid, lime, alumina, peroxide of iron, and silica; also chlorine, soda, magnesia, and traces only of phosphoric acid.

The Late Explosion at the Cincinnati Gas Works.

[We publish the following letter, taken from a Cincinnati paper, written by Samuel A. Thomas, Engineer of the Cincinnati Gas Company, wherein he gives an explanation of the cause of the late explosion of their meter.—Eds.]

CINCINNATI, June 4 1869.

To the Editor of the Cincinnati Gazettee:

As I have frequently been alluded to in the papers as Engineer of the Gas Works, and statements attributed to me that I never made, perhaps it would be as well that my own statement should go before the public, that the people may know just what I did see at the time of the recent explosion, and what is my opinion in regard to its origin.

I was sitting at one of the windows of my office, which is directly opposite the destroyed gas holder, on the north side of Front street, about sixty feet distance from it, and my room being in the upper part of the building, gave me an excellent view of the catrastrophe. I was not looking toward the gas holder at the time of the explosion, but when my attention was called by the loud report, my eyes were immediately turned in the direction of the sound, and I found I was looking directly toward the center of the gas holder. I saw the gas holder split across the crown, the gap gradually widening till the opening must have been ten feet in width. I saw the fire descend into it and ignite the gas, and in an instant the whole body of the gas was in flames. A hotter fire for the time it lasted I never experienced. Had it lasted fifteen or twenty minutes the whole neighborhood would have been in flames, but I think in less than three miuutes from the time of the explosion the gas had all been consumed and the gas holder lay a mass of ruins in the bottom of the tank.

Not a particle of it fell outside the walls of the tank, even the two globes and eagles that were torn from the tops of two of the columns fell inward. This proves conclusively that there was no explosion of gas inside of the gas holder; if there had been its fragments would have beeu scattered in all directions. As soon as the crown had split open I was forced to leave my position, at the window by the unbearable heat, it had gone down two-thirds of its height. When the gas had all been consumed it collapsed and fell in a heap in the bottom of the tank.

Now, in regard to the cause of the explosion. The public have already been informed that one of the men engaged at painting the gas-holder, from the inconvenience of getting down as it then stood, concluded to remain where he was and have his dinner brought to him Had this man come down like the others it is my firm belief that he would this day be alive and the company would not have to regret the loss of a large amount of their property. The gas-holder was in a leaking condition and the men were engaged stopping the leaks and putting a fresh coat of paint on the holder and suspension frame. The sides were completed, but the crown was not. The gas that leaked from the crown mixed with the air directly above it and formed an explosive mixture. The pipe was lighted, the match thrown down and the mixture exploded. The pipe was found directly after the occurence, still containing fire and hot ashes. The explosion being directly on top of the gas-holder it was driven with great force down into the water, compressing the gas within it, till the outward pressure became so great that the crown sheets were unable to resist it and they split open as above described. The fact that the pipe found beneath the point where the man had been standing was recognized by his wife as the one he had been in the habit of smoking, added to the fact that the man was known to be an inveterate smoker, I think affords a reasonable insight as to the cause of the explosion. Neither the foreman of the works or myself knew that the man had remained on the gas-holder when the others came down to dinner, or we would not have allowed him to do so.

The Gas Company has been accused of pumping air into their gas holders. It would not be to the company's interest to do so Both the constituents of common air are highly injurious to the illuminating qualities as the gas, and reduces its quality in a much larger proportion than its quantity is increased. The company have all they can do to keep their gas up to the required standard with pure best quality of Pitsburg coals. As the works are now conducted, it is impossible to pump air into the gas-holders. The retorts are worked under a pressure of one and a half inches above the pressure of the atmosphere, and if there are any cracked retorts in the benches, gas will leak out instead of air being taken in. The company last year, at great expense, had a patent automatic governor placed upon the pumping engine to prevent the possibility of air being pumped in by the engineer allowing his engine to run at too great a speed. The governor is operated by the pressure of the gas on the retort side of the exhausters. When the pressure gets down to the lowest allowable point, the steam valve is partially closed and the speed of the engine checked, the steam valve being opened again as the pressure raises, increasing the speed of the engine. This machine has been found to work well, not allowing more than a quarter of an inch variation of the pressure guage. With this apparatus attached to the engine it is impossible for the engineer himself, if so disposed, to pump in air, unless he first detatches it. Something has been said about the gas being rarified after it is put into the holders. There certainly is a rarification of the gas going on every clear day.

When the heat increases as the day advances, the gas is expanded by the heat of the sun, and the holder is raised in proportion to the expansion; the expansion being proportionate to the amount of gas contained in the holder, and the differance of temperature between the hotest and coolest parts of the day. But when the evening has come, and the temperature has cooled down to the point at which it was in the morning when the gas was put in, the holder will have gone down to the same point it started from also. The public should understand that a gas holder cannot be bursted by the expansion of the gas inside of it under ordinany circumstances. It is free to move up and down and accommodate itself to the quantity of gas put into it, or to the expansion of gas that is already put into it. The weight of the gas-holder is the utmost pressure put upon the gas, and that is the ordinary pressure used to drive the gas to the consumers. In conclusion, I will say that we have investigated the matter to the best of our abilities, and can account for the explosion on no other theory than the one above stated.

SAMUEL A. THOMAS, Engineer.

Another Proposed Ship Canal.

The Greek correspondent of the "*London Times*," writes: "The project of cutting a canal through the Isthmus of Corinth has been again discussed at Athens and some people here think that circumstances render the execution of the enterprise perfectly practicable and ultimately useful, even should it not be immediately profitable. In a few months the work of M. de Lesseps at the canal of Suez will be so far completed that a number of powerful machines, admirably suited for the work at the Isthmus of Corinth, may be obtained at a comparatively small cost. Skilled workmen will also be ready for employment, whose labor could be obtained at an expenditure trifling in comparison with what Greece would be called upon to pay under any other circumstances. No such favorable opportunity of constructing a canal through the Isthmus of Corinth is very likely to recur. A glance at the map of the Mediterranean shows how important such a canal would be for the trade of all the ports of France, Italy and Austria with Smyrna, Constantinople and the Black Sea. The ports at both ends of the canal would not require any very great expenditure, and the canal, if made, could be kept open at very little cost. Its length would be three miles and three-quarters, but there is an elevated plain of limestone through which it must be carried that rises to an elevation of 250 feet for a length of more than a mile. It is calculated that to construct a canal 150 feet broad and 40 feet deep would require the excavation of about 12,000,000 cubic yards of rock and clay. Whether the work would be profiable or not to a commercial company, there can be no doubt that it would be more useful to the Greek nation, and would not cost more money than a fleet of iron clads to drive the Ottoman fleet out of the Archipelego, for which the Hellenes are raising subscriptions."

BÉTONS AGGLOMÉRÉS, OR ARTIFICIAL STONE.

[*Written for this Journal.*]

No. III.

We had expected in this numbar to present our readers with full practical details regarding the gigantic Paris aqueduct, now in course of construction, entirely of fine sand concrete, and more especially of that section of the work which spans on ninety-seven arches one of the valleys of the forest of Fontainbleu, known as the "Arcade du Grand Maitre"; but owing to the non-arrival of the documents on the subject that we are to receive from France, we have to put it off for a future occasion.

However, the subject of concrete construction is now attracting so much attention in this country, and, from the numerous inquiries we receive regarding the bétoncoignet, we see that the true haracter of this new building material is so little known and understood by our community, that we propose in this number to present a few facts which, if perused carefully, will not fail to demonstrate clearly the difference which exists between the béton agglomérés and all the concretes which we have hitherto employed in this country.

In a remarkable paper on this interesting subject, lately read before the American Society of Civil Engineers, by L. F. Beckwith, C. E., speaking of the applications of the béton coignet this gentleman remarked:

"Arches and vaults built of a single block of béton act like a slab which has been partially hollowed out beneath: they, consequently, have less lateral thrust than if composed of vousoirs of separate blocks of stone. The versed size of these arches and vaults is generally from 1 10th to 1 15th of the span. The rapid setting of the material enables the centres to be struck within a few days.

"Various experiments have been made, with good results, to test the strength of béton for arches In December, 1864, the engineers of the Ponts et Chaussées experimented on an arch of béton, of 39.36 feet span, 0.82 feet thick at the crown, and 3.28 feet wide. At the end of a year a rectangular block, 1.148 ft. wide by 0.656 feet long and 0.82 feet deep was first cut out of each side of the crown, leaving a section 0.82 feet deep by 0.984 ft. wide to sustain the whole thrust of the arch.

"This section was successfully diminished in width from 0.984 feet to 0.328 feet, then to 0.197 feet still retaining the depth of 0.82 feet, and finally to 0.164 feet, with a depth of 0.656 feet at which point rupture took place. This experiment proves, in a satisfactory manner, the enormous resistance to crushing which béton-coignet is capable of.

"An experimental arch on the Quay de Billy has a span of 52½ feet; versed sine, 4 feet; thickness of crown, 14 inches, with good results.

"Béton is used for arches and vaults in the structures of the Northern Railway at Paris, the new prison of the Madelonnettes,, and in the new barracks of Notre Dame. In the latter an arched vault was built of 18 feet span, 1½ feet versed sine, 8½ inches at the crown, with surface of 14 square yards, on which experimental weights of 47 tons were placed for a fortnight without damage. Béton was afterwards used for all the similar arched vaults in the building, giving a surface of 3,588 square yards.

"At Vitry-en-Perthois a bridge of béton has been built, consisting of 2 arches, each 54.94 feet span and 4.26 feet versed sine. This bridge resists a pressure at various points of 711 pounds per square inch, and its cost is the same as if made of wrought-iron girders arched with brick.

"In the winter of 1866, several arches of béton-coignet, 18 feet span, were built under the stair-approach from Westminster Bridge to the southern embankment of the Thames: and, notwithstauding some very severe frosts, the work suffered no delay and gave good results. As a precaution against frost, it is prudent to cover the work with tarpaulins.

"At Aubervilliers the machinery of a considerable saw-mill is placed on an arch 33 feet span; versed sine, 6½ feet.

"Mr. Coignet exhibited at Paris, in 1867, several arches of béton; also half an arch springing from a pier and cut square off at the crown, maintaining itself in that position by its great tensile strength alone.

"The ventilation of the Exhibition building at the Camp de Mars is effected by underground works consisting of a series of circular and radial galleries, arched with béton, span about 10 feet, for the circulation and supply from below of cool air through openings in the floor.

"The outer gallery is 33 feet in width, 8.2 feet high, and 1,443 yards in length. The groined arches of béton, 5½ inches thick at the crown, are supported on two rows of béton pillars, 1 foot 2 inches square and 864

in number, carrying a roof, the upper surface of which forms a béton floor of 15,873 square yards of surface.

"The quantity of béton consumed in these galleries was 353,166 cubic feet.

"The materials of this structure were: four parts of sand, one of lime and one half of Portland cement.

"*Walls.*—The embankment on which runs the Avenue de l'Empereur, at the Trocadero, for a quarter of a mile is supported by a wall of béton about 40 feet high. The outer side is strenghtened by pilasters; the inner side consists of a series of arches at right angles to the wall, built one upon the other and extending into the embankment, forming a bearing for the mass of earth, and diminishing its lateral pressure against the wall. The wall and arches are a solid mass of béton.

"The breast-wall of the cemetry of Passy, 50 feet high, is being built of béton.

"The steeple of the Gothic Church of Vesinet is constructed of béton, 130 feet high, and shows no sign of weakness."

"*Floors, Terraces, Roofs.*—If the area does not exceed 13 or 16 feet in width, a slab of béton 10 or 12 inches thick will be strong enough to sustain itself; if the area be greater, double T-joists of iron should cross the space for ceilings, floors, &c., and the slabs of béton may be made thicker or thiner, depending on the distance of the joist one from another, the flanges of which form the holding of the slabs.

"Joists being thus placed, and a temporary scaffolding or a floor of boards erected underneath, the béton is dumped upon it and packed; the edges hold upon the flange, the béton hardens, the scaffolding is removed, and the ceiling remains firm. If the upper side should serve for a floor also, the béton should be laid thicker, and carried over the joists so as to form a smooth surface above them.

"Béton may be succeesfully used for fire proof roofing.

"Béton for this work should be five parts of sand, one part of lime, and one-fourth part of cement.

After the above statements, coming from a gentleman of such known abilities as L. F. Beckwith, Esq., who has had unequalled opportunities for investigating the subject, when connected with the United States Commission at the last Universal Exhibition of the Industry in Paris, we will dispense from speaking of the latest experiments and application of the béton coignet to establish its standard as a building material; but we would here remark that there is as many grades of quality in the béton agglomére as there are in the sorts of natural rocks we use for building; so that as a substitute for either the coarsest masonry or for the wants of ornamental architecture, the béton-coignet may always be made to replace advantageously, both in price and quality, most of the natural stones employed in the art of building; whilst in the construction of monolithic structures it stands *unique, alone*, and *without a rival*, and therefore without the possibility of a comparison with other material.

Engineering Chemistry.

[From "Engineering"]

Chemistry, though the grandest of the sciences, and scarcely older than the present century, is probably second to none in the importance of its bearing on most branches of industry. But, notwithstanding this fact, the cultivation of chemistry as a science is, in this country, left entirely to the accidental interest of individuals; and it is almost exclusively in connection with medicine that the principles of chemistry are taught at any of our educational establishments. We have not in this country, a single chair of general applied chemistry, and, with the exception of the professorship of metallurgy at the Royal School of Mines, there is no provision for teaching the special application of chemistry to any branch of industry. Though we have some able chemists, their functions are almost entirely educational, or they cultivate chemistry merely as amateures, while the application of chemical knowledge and skill to industrial arts is so far from being recognized as a profession, that, like engineering a century ago, it is a pursuit offering little definite prospect to those who might be disposed to follow it, and one that is taken up only under chance circumstances. We are, however, of opinion that there is not only room for, but a great need of, a class of competent chemists who would devote themselves to the practical applications of this science, and to whom manufacturers, engineers and others, could safely apply for advice and assistance in cases involving the consideration of chemical principles and knowledge. Among engineers generally it is, in this country, very seldom that any great acquaintance with chemistry is to be met with; and even manufacturers, as a class, do not generally possess such an amount of chemical knowledge as would be desirable and necessary for the most efficient practice of their arts. Nor can it be expected that either engineers or manufacturers should in any case become so far masters of chemistry as to supersede the necessity for advice and assistance from those who have specially devoted themselves to the study of the science in its practical bearing. One of the most serious obstacles that stand in the way of the formation of any such class of professional chemists as we have refered to, is the absence of any criterion by which the competence of chemists may be judged of, and qualified men distinguished from the host of quacks and charlatans who dub themselves chemists. Consequently, the only thing by which the public can be guided, is the fact of a chemist holding some position or office, of which there are, in this country, hardly any which are not purely educational. Even those are very few compared with the want that exists from sound chemical teaching, and those few chiefly fall to the lot of chemists who devote their attention to abstract chemistry rather than to its practical application. We do not pretend to say how any wider criterion of chemical competence is to be established, but we do not hesitate to express the opinion that it is very much needed at the present time.

As regards more especially the application of chemical knowledge to engineering, there are unquestionbly many branches of this profession in which it would be of the greatest value, and somewhere it is indispensible. Thus, for instance, in regard to the subject which is probably the greatest engineering problem of the time, viz., the disposal and utilization of town refuse, and waste products of manufactories, etc., together with the maintenance of rivers and other accumulations of water in a proper condition, both as means of communication and sources of water supply for towns; it is imposible that it should be properly dealt with unless the chemical aspect of the subject is fully considered. Indeed the many serious evils arising from polluted rivers, sewage infection, and the waste material that would be of service in maintaining the fertility of land, are in a great measure to be ascribed to the one-sided views under which the present system of disposing of town refuse by water carriage was introduced, and to the disregard of those chemical principles which would have indicated the probable consequences of that system unless it were supplemented by measures for dealing thoroughly with the material to be removed, and not merely transforming its noxious influence from one locality to another. To this circumstance also must be ascribed the dead lock now existing in regard to sanitary regulations, and the improvements of the conditions of towns by the construction of sewers.

The subject of artificial illumination and the questions as to the requisite purity and proper cost of illuminating gas constitute another field in which the services of the practical chemist may be of advantage to the engineer, and where the co-operation of engineeres and chemists can alone be expected to lead to satisfactory results. Not in any way less important, or less capable of improvement by such united efforts of engineering and chemical skill, is the subject of economy of fuel. In the production of motive power, in the heating of dwellings, the various branches of metallurgic art, and in many other cases where fuel is employed, the quantity consumed is in excess of that requisit for effecting the object in view.

Improvements in this direction would be a source not only of individual profit, but also of national advantage. We might extend the illustration of our views on this subject almost indefinitely, but we apprehend the possible profit of and urgent need for greater attention being paid by engineers to chemistry is very widely appreciated in the profession, and therefore we confine ourselves to mentioning the subject, in the hope that others may suggest a means of giving practical effect to our views, and make some effort toward carrying them out. The recognition of science by the state is as set a principle too little acted upon in this country to warrant much hope of this idea being promoted from that direction; but our private societies, as much as the Institution of Civil Engineers and the Society of Engineers, are sufficently strong to take the initiative in this matter, and they might do good survice by giving their support to some feasible plan for bringing chemistry more within the range of the engineer's notice, and making chemical knowledge more readily attainable by him than it is now.

There are nearly 1,000 Gas Companies in the United Kingdom, says a London paper, without statutory powers for carrying on their undertakings, besides 70 carried on by private individuals, every one of which is liable to be dispossessed of its property by enterprising speculators in the manner in which it is probable the Aberdare Gas Company are about to be dispossessed of theirs by a new competing company, who have succeeded in obtaining sanction for their operations from a committee of the House of Lords.

Liquid Fuel.

ITS PERMANENT SUCCESS AND PRACTICAL RESULTS.

As our readers know, we have taken great interest in the progress of this American invention. From the begining, we reorganized it as one of the highest importance, and which at an early day was bound to achieve complete success, and take rank in point of commercial value among the first improvements of the age. That we were not mistaken in our estimate is being most fully proven.

On Wednesday of last week our reporter went to a large malleable iron foundry in Paris to observe the practical working of this system, in the melting and casting of iron and steel. Quite unexpectedly he found a large number of distinguished persons present for the same purpose. Among the gentlemen, he observed Major General Dix (the American Ambassador), the Secretary of Legation, Mr. John Munroe, banker; professors, engineers, chemists, and others interested in such matters. All the operations were attended with entire success, and evidently gave great satisfaction to all present. Our reporter took ample notes of the proceedings, but having since been favored with a copy of the following correspondance, embracing a succinct report from Major Bray, a scientific and most reliable engineer present, we prefer to lay that before our readers, believing it to be of higher authority than anything we could say on the subject.

PASSY, PARIS. GRAND RUE, No. 71,
April 30, 1869.

Mr. J. A. Works,

No. 267, Rue St. Honoré, Paris.

Dear Sir,—Allow me to return you my sincere thanks for the invitation given me to be present at the first firing up and melting of iron, in your Liquid Fuel furnace in this city, and to enclose you a copy of the brief report I have made to my employer thereon. Be kind enough to convey to the constructor-in-chief, Mr. B. McFarland, also, my acknowledgements for the facilities he afforded me in my investigations of the subject.

I remain, sir, very truly yours,
W. THOS. BRAY, Engineer.

I arrived at the iron foundry, where the furnace in question is situated, at 1.45 in the afternoon, and found the fire just lighted. The metal chamber was intended to contain four crucibles of the ordinary size, the whole structure being rather crudely built, costing, as I learned, only about four hundred francs. The furnace being new would have required some twelve hours continuous firing with coal before getting hot enough to receive the first charge of iron. Fed with Liquid Fuel, however, it was ready in three hours and twenty five minutes. The crucibles were then filled with scrap-iron, which had been once before melted, in order to give the system a severe test, and in one hour and fifty-five minutes the metal was thoroughly reduced, and run out into moulds in the ordinary way. I examined the cast closely, found it to be a beautiful run, and evidently a superior grade of metal. I did not remain to see other heatings, if made, but all familiar with these matters know that subsequent charges could be worked in less than half the time, and one-third the fuel required at first. Steam is required, to be admitted in a certain way, in order to the perfect working of this improvement, but not being available in this case, water was employed as a substitute. The material used as fuel was a waste or refuse, possessing heretofore no value, and in one form and another is found in unlimited supply in all parts of the world. There is estimated to be three times as much of it as there is of coal, can be delivered anywhere at the same price per ton as coal, and is worth really three times as much for heating purposes, besides being entirely free from all sulphur and phosphorus. In the present case the amount of heat generated was quite sufficient to have worked double the number of crucibles, the cost of the fuel used merely nominal, the labor and attendance upon the fire, etc., reduced three-fourths, and above all, a much better article of manufacture obtained. The fire can be reduced or increased at pleasure, and almost instantly to any required degree, and there is no opening of doors to let in cold air upon the cooking metals at inopportune moments. The furnace itself is simple, durable, and extremely economical to construct, and to operate afterwards. The principle of the furnace is such as to furnish the combustion with a continuous hot blast, and also with a suitable supply of superheated steam, which, united with the burning carbon, gives extreme intensity of heat. The same principles are also applied to bath, reheating, and smelting furnace.

Mr. A. J. Works is the inventor of this system of fuel and furnaces, and which from its evident importance has already elicited considerable attention from

the press and public, both in England and on the continent. Mr. W. is also the inventor of the only successful method of of applying Liquid Fuel to steam generation.

* * * * * * * * * *

In conclusion, the trial I witnessed to-day was *a most complete success in every particular*, and that too under such circumstances as to put the invention to the severest possible test; with one or two trifling changes, which will be made in subsequent constructions, the Works' system of Liquid Fuel Furnaces will be complete, and by far the cheapest, most economical, and efficient of any yet presented to the puolic; and I have no hesitation in recommending the same to all persons interested in such matters.

W. Thomas Bray.
Engineer to Prince S. A. Dolgorouki,
St. Petersburg.

Paris, April 28th, 1869.

(*American Register.*)

The Electric Lamp.

Mr. John Browning, F. R. A. S., the optician who manufactured the great telescope for the goverment of India to photograph the late eclipse, has contrived a most ingenious, simple, convenient, and cheap automatic lamp. For all purposes, whether of photography or lecture demonstration, this lamp will be equally suitable as the older forms, since it gives a steady intense light, and, so to speak, manages itself. As the light, however, is, though brilliant, yet small, it is necessary that the lenses and pictures employed in demonstration with the lantern be of a very perfect character, else striæ will make their appearance. This lamp will in most cases supersede the lime lamp, because not only is it prepared for work in a few moments, but all chance of explosion (to which the lime light is very liable) is completely removed. The plan of construction differs from that in use in the ordinary electric lamp. In those the carbon points are pulled a limited distance apart by automatic electro-magnetic apparatus, that distance being sufficient to give the maximum of light without breaking the flow of the current. In the new lamp, there is no pulling apart of the carbon points, the battery power being so weak that all such movements would be useless. The principle adopted in the case before us is to let the carbon points touch each other, and to clamp them in that position, so that the current has to burn an interval between the two points for itself. The battery power used is very small, about six Groves' cells. The moment the current ceases to pass the magnet ceases to be a magnet, the armature rises, the clamp is loosened, and the bar falls, and approximates the points sufficiently to continue the current, and then the armature is again drawn down, and the bar clamped.

It might be thought from this that the light would be an interrupted one, but this is not the case. The cessations of the current are of snch extremely short duration that the impression of one flash does not leave the retina before another appears, so that the light from the lamp is practically constant. If the ear be applied near the lamp, feeble vibrations indicating the making and breaking of contract will be heard, but the eye can only see a steady continuous light. With a battery of six or eight cells a 9ft. lantern-disc may be brilliantly illuminated, and this lamp, with regard to cleanliness, cost, efficiency, and absense of danger, has no competitors.

How to Detect False Diamonds.—The more valuable an article is the more it is counterfeited, and the greater the perfection to which falsification is carried The diamond has been so successfully imitated, that he must be an expert indeed who can tell the false from the true. It by no means follows that because a man deals in jewels his honesty must be of the first water, and the fact of a purchaser having paid for a diamond is not always proof that he has obtained one. There are known tests of genuineness, it is true; but they are chiefly optical, and require apparatus and skill to make them. A method which any one can apply, or easily get applied, has been discovered by an Italian chemist. If you have a doubtful stone, put it, or cause it to be put, into a leaden or platinum cup, with some powdered fluor spar, and a little oil of vitriol; warm the vessel over some lighted charcoal, in a fire-place, or wherever there is a strong draft to carry away the noxious vapors that will be copiously evolved. When these vapors have ceased to rise, let the whole cool, and then stir the mixture with a glass rod to fish out the diamond. If you find it intact, it is a genuine stone: but if it is false it will be corroded by the hydrofluoric acid that has been generated around it. A small "paste" diamond would disappear altogether under the treatment.—*Morgan's Trade Journal.*

Correspondence.

[Correspondents in all cases should sign their communications with their names and address in full, not necessarily for publication, but as a guarantee of good faith.—Eds.]

New Albany (Ind.) Gas Works—A Word About Clay Retorts.

New Albany, Ind., June 8, 1869.

Messrs. Editors: As all reports on gas in your Journal are read and highly appreciated by me, it may not be out of place, while I enclose subscription, to let you know how we get along. A few of your readers, in connection with small gas works, have written requesting my opinion on Clay Retorts. As all have not been answered I would say to them that we have 390 meters at work, and soon to be increased to 400; we have 153 street lamps at work since the 1st of April, which received their supply from one bench of clay retorts; three retorts to a bench; dimensions of same as read from Brand, 14 by 22 inch, 8½ feet long, contracted at mouth piece to receive a 12 by 20 inch mouth piece. The bench was erected by myself, and from it I found, when pushed, that 900 pounds could be carbonized every four hours, yielding 24,000 feet every twenty-four hours, and fifty bushels of coke could be put in store for sale. The quantity of tar made I cannot exactly say, but know it was very little. I have been informed by our Plastic Slate Company that plastic slate, as made by them from our tar, requires 500 lbs. per barrel. As we could not supply their demands they had to be supplied from other gas works, all of which required from 125 to 280 lbs. more per barrel than ours. I also find that a heat which will produce the above results from day to day, would melt things. The 3½ inch tiles that protect the bottom of top retort wilted like a warm pancake, and in one week we had to replace the same four times, the retorts in other two benches being all out, in order to put new ones in, and neitber new or old ones being about the place, I can assure you I was in rather an unpleasant fix, as I had no other bench to fall back on. I have also found that 18,000 or 20,000 lbs. may be made daily without any serious injury to same tiles; yet I am convinced that the material may be had and so constructed to stand the heat necessary to a production of 10,000 feet per retort every 24 hours. Pittsburgh coal is used exclusively; the brick work is so constructed that the stand pipes are kept cool, and do not get choked; we make but little carbon, yet we find it necessary to burn out every four months; time required for same from twenty-four to seventy hours. A crude description of our works may be found in your Journal of May, 16 1868. We have no exhauster, neither have we any new improvements yet to report.

I have found gas business and articles on gas in your Journal for the past twelve months very interesting but my inexperience as a letter-writer, combined with fears of the waste basket, forbid my extending this article just now, and will add no more at present, but remain still your subscriber,

John Dunbar,
Sup't Gas Co., New Albany, Ind,

Legitimate Enterprise.

Terre Haute, Ind, June 9, 1869.

Messrs. Editors; A circular from F. W. Christern, of New York, in reference to a German work, "by N. H. Schilling, translated into French by Ed. Servier," has been received. Now, to the large majority of gas engineers and superintendents, this apparently valuable treatise on gas lighting is a sealed book, excepting through the plates. The price is also high for persons of moderate means—$13.20 in gold.

Now, I would suggest, "as the book contains, as a prominent part, a great number of drawings executed with the utmost care and exactness, and giving, in addition to the wood engravings printed in the text, a complete image of the present state of gas making, which every American reader not fully versed in French will understand *without the letter press*," that Mr. Christern enter into an agreement with the French translator, to furnish him the plates and wood cuts, *without the letter press*, which could probably be obtained at a greatly reduced rate, and get some competent person to translate the chapter supplied by Mr. Arson, the Chief Engineer of the Parisian Gas Company, on the passage of gas in long pipes, with the complete tables, prepared by him: or if this would cost too much, let him get the plates and tables alone, and I think it would be just as valuable as at present, with the French letter press. This could certainly be done at a very reduced rate, and would sell rapidly.

There is one part of the preface to Mr. Servier's work, which has in it a world of truth, but which it seems our gas engineers and superintendents *cannot appreciate*, as that celebrated Convention we urged so earnestly seems to be an *impossibility*. He says, "It is an old saying, that contrary opinions serve to promote the truth, and this saying is certainly confirmed in the preparation of gas. The Germans have understood this, and have founded the X X X or "Society of the Gas Engineers of Germany," which assembles every year in a different town, to discuss questions which are the order of the day. In the intervals of the annual meetings communications are made (what a God-send they would be to you, should gas engineers here ever screw their courage up to the *acting* point) by the members of the society and are inserted in the *London Journal of Gaslighting*, which is its organ. The advantage of these meetings is incontestible, for beside the technical communications, the gas makers treat of the interests common to all of them," etc.

Now, if you would urge Mr. Christern to undertake this legitimate enterprise, I think you would confer a great favor on gas engineers and superintendents.

R.

Comments on an Editorial under the Captcn, "Enterprising."

Terre Haute, Ind. June 10th 1869.

Messrs Editors: In your issue of June 2nd you have an article under the caption of "Enterprising," the sentiments of which we do not like and cannot endorse, especially where it urges other gas companies to "see an example worth imitating."

Gas companies are, we think, improperly termed monopolies, because there are other methods of obtaining artificial light besides using gas. Now, why increase this odium, by engaging in other than the ligitimate business of such companies,—viz., manufacturing and distributing the gas through the street mains, and by the service pipe into the houses; why crush out individual enterprise? Why not permit competent mechanics to use the pipe and furnish the fixtures in private and public houses, the price to be regulated by competitions, which will always bring it down to a fair rate for the consumer and mechanic.

This same company should be still more enterprising (we will be liberal and give our advice gratis), let them set up a coal yard to supply the citizens with fuel during the winter, sell lime for building purposes &c. &c. We think the Manhatten, New York and Metropolitan Gas Companies in New York if they should follow your advice, would raise such a howl of indignation among gas fitters and those who retail gas fixtures, as would soon cause them to regret the more, and make them confine themselves to their proper business.

If a gas company feels inclined to be liberal, let them furnish their service pipe and meter connection gratis; this is a heavy outlay generally in all small towns; also not charge meter rent.

The running of the service etc., is uniformly done by gas companies, and no one would complain; if they wish to be still more generous let it be done in the proper line of their business, and we would suggest that this liberal company lower the *price of their gas to cost*, and that they may not be considered partial, let it be done, not only to those on a "new line of pipe" but to all their consumers, and we think that by our plan they would rapidly increase the number of their consumers. We are inclined to think they will find that their "bread cast upon the waters, will return to them," well soaked and not of much value. R.

The Late Cincinnati Gas Explosion.

OHIO, June 9th 1869.

Messrs Editors; It is not fair that the idea of mystery should prevail as to the Cincinnati explosion. Truth does not seem to warrant the assertion "no fire in the cauldron." The *Commercial* says: "The fire under the cauldron, already mentioned, communicated to the contents." Cover it as you may with the nonsense of "solar heat," here is clearly the source of the explosion, for in that terrible few minutes that succeeded the disaster, they certainly *let* no fire, and it was this same fire that frightened the crowd, and caused the succeeding mischief.

I regret the occurrence, but we want it clearly understood by every person, that pure coal gas is not explosive, and can only be made so by admixture with oxygen or air. Yours as ever, OHIO.

Effects of Drainage and Water Supply.

[From the London Builder, May, 1869.]

The inestimable advantage which spring from an abundant supply of pure water, and a well-devised system of sewerage, are every day becoming more appreciated, and in proportion as these benefits are valued so will the scientific works of the engineer be acknowledged. The Registrar-General has just issued his quarterly returns of the rate of mortality, in which he specially alludes to forty-six of the principal towns of the United Kingdom. There is one town quoted in the list which probably more than any other shows the beneficial effect of drainage and water supply. The town to which we now particularly refer, is Swansea, Glamorganshire, a town which in itself contains elements for a high death-rate, but which is now quoted by the Registrar-General as the third healthiest of the forty-six towns enumerated. This town now contains a population of 66,000 inhabitants, and it is well known is the seat of the largest copper smelting works in the kingdom, something like two-thirds of the whole of the copper ores of the county being smelted in the immediate vicinity. Then it has gigantic iron works, tinplate works, arsenic works, and other manufactories, which emit dense volumes of smoke, so much so, indeed, that the inhabitants may be said always to live in smoke and the adjacent hills and districts are entirely denuded of vegetation. At one time high medical opinions were quoted, to show that the atmosphere, impregnated with the deleterious vapors and smokes from the works, must have a prejudicial effect upon life and health, and certainly the opinion of the medical faculty. The inhabitants, however, and their representatives felt that if they lived in smoke they also lived upon or by smoke; that is, that the stability of their trade and commerce depended upon the prosperity of their large works. Impressed with this opinion, they did not make a crusade upon the proprietors of these works, compelling them to put the provisions of the "Smoke Nuisance Act" into operation; on the contrary, the whole town, in public meeting assembled, determined to reject the Act, for which we give them no praise, but the contrary. They will see their error presently. It was, however, felt, upon the other hand, that the rate of mortality was higher than should be reasonably expected, notwithstanding the adverse circumstances to be contented with. It was determined, after much controversy in the Local Board of Health, that a perfect system of drainage should be carried out, and that an abundant supply of pure water should be obtained, at whatever cost. Some ten years since, therefore, the sewerage works were planned, and have since been carried out under the personal supervision of Mr. Edward Cousins, the present surveyor of the Local Board; and up to the present time upwards of forty miles of brick and pipe sewers, varying in size from 3 ft. 9 in. by 2 ft. 5 in. to 2 ft. 3 in. by 1 ft. 6 in. (egg shape), and pipes varying in size from 18 in. diameter to 6 in. diameter, have been laid. The house-drainage is in process of being carried out, about 4,000 houses having been connected out of a total of about 8,000 houses in the borough; and this drainage has been carried out at a cost of about 40,000*l*., in round numbers.

During the progress of the work the most remarkable results have been noticed and carefully recorded by Mr. Ebenezer Davies, the Officer of Health. In the event of any outbreak of fever or epidemic of any kind, those parts of the town through which the main drainage had not been carried were invariably its hotbeds, and in some instances fever proved fearfully fatal where no drainage existed, whilst in the same locality but where the drainage had been carried, there was a happy immunity.

But not only was drainage resorted to with such beneficial effects, the corporation, or rather Local Board of Health, determined upon seeing a most abundant supply of water, not only for domestic, but for trade and flushing purposes; and at an outlay of somewhere about 100,000*l*., they have succeeded in constructing a splendid reservoir at the Lliw, capable of storing no less than three hundred millions of gallons, or a supply to the town of no less than four months, without any rainfall whatever. This water, according to scientific analysis of Mr. F. Grace Calvert, of Manchester, is exceedingly pure, containing only 2 degrees of hardness, whilst the London water generally contains about 12 degrees. The Swansea water is the nearest to that of the celebrated Loch Kathrine, Scotland. The water of the Lliw has been conducted through eight miles of graduating conduit, and about twenty-five miles of distributive mains have been laid. These works were designed by Mr. R. Rawlinson, C.E.

The distributive mains have been superintended by Mr. Cousins, the borough surveyor. At present 7,000 houses in the borough are supplied with water from the reservoir, and there can be no doubt but that in a few more years the work will yield a very handsome revenue, far more than applying the interest upon the outlay made. The receipts from the water works now amount to about 6,000*l*. per annum. The combined effect of these two important works has had the most satisfactory, and we may say extraordinary, result upon the public health, and has enabled the Registar General to place Swansea in its present position of the third healthiest of the forty-six towns he has enumerated. Prior to the carrying out of the drainage and water supply, the rate of mortality in Swansea was about 26 per 1,000. The last return of the Registar-General now shows it 18·37 per 1,000, and one month it was as low as 12·35 per 1,000, whilst the tables of sickness kept by the large clubs of workmen show that the general health of the borough has most materially improved. We can scarcely be wrong in attributing much of this good result to the improved sewerage and abundant water supply provided for the town.

Foreign Gas Items.

We clip the following items in relation to foreign gas companies, from *Morgan's British Trade Journal* of May 3rd:

BAHIA GAS CO.—A dividend at the rate of 3 per cent per annum on the ordinary shares is announced: surplus, $1,915.

CHARTERED GAS CO.—By the legislation af last session profits were temporarily reduced, the gas being of greater illuminating power and the residual products of less value. The mild winter had also reduced profits. A dividend at the rate of 4½ per cent per annum only could be recommended for the past year. An amalgamation with the City of London Company was under consideration, and the new works at Beckton were being proceeded with. Half year's revenue $755,645; expenditure, $664,410.

PARA GAS CO.—A call of $10 per share on the third issue of shares is announced as due.

RIO DE JANEIRO GAS CO.—The available profit was $246,285. A dividend at the rate of 10 per cent per annum was declared, and $85,000 was carried to the insurance and contingency fund; surplus, $11,285.

SAVOY CONSUMERS' GAS CO.—Six months' net profits, $54,085, equal to a dividend at the rate of 10 per cent per annum, and a surplus of $1,586.

SINGAPORE GAS CO.—The available surplus was $6,335, out of which a dividend at the rate of 7½ per cent per annum, free of tax, was announced; surplus, $125.

Coal in New Granada.

Although it is thought that there is no country in South America where larger coal districts are to be found than in New Granada, now called the United State of Colombia, little or nothing has as yet been done towards turning them to account. In one or two spots, according to a report of Mr. Bunch, the British Charge d'Affaires at Bogota, within the reach of an accessible market, and where iron is found in its immediate neighborhood, coal is employed to a very limited extent, but the works are carried on without system, and nowhere is machinery used. Latterly, however, the attention of the public and of the government has been directed to immense coalfields, said to have been found in the province of Rio Hache, near the Atlantic coast; and, with the concurrence of Congress, steps are about to be taken to render the discovery available. Were the quality of the coal, Mr. Bunch remarks, such as it is described, its value would, from its proximity to the sea, be greatly enhanced; and the government, to whom the mines belong, would derive no small advantage by supplying the great ocean steamers which touch at the Atlantic ports of the Republic and those of the Isthmus of Panama. The coal would also find a ready market in the West Indies. At present several lines of railway are projected (among others, one from Barranquilla, on the river Magdalena) to the sea; and the prospect of obtaining good and cheap fuel will facilitate the undertaking.

Prices of Gas Coals—June 16.

PROVINCIAL.

Duty, $1 25	Coarse. Gold.	Slack. Gold.
Block House	$1 75	$1 00
Gowrie	1 60	0 90
Lingan	1 75	0 75
Sydney	2 18¾	0 71½
Pictou (Albion)	2 25	1 25
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[NOTE BY PROFESSOR WURTZ.—Contributions and items for which I am, as a Scientist, individually responsible, will have attached my full name or initials.—H. W.]

WEDNESDAY, JUNE 16, 1869.

WISHING TO MAKE this Journal an organ of intelligent discussion to those of our readers who may wish to gain or give information on the subjects to which its columns are devoted, the publishers olicit letters from all among them who make the study of those subjects a pleasure, or a profession.

Subscribers would confer a favor upon us by remitting *CHECKS* or *POST OFFICE MONEY ORDERS*, as we are frequent losers where money is enclosed in letters.

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McKENZIE'S COMPOUND GAS COALS.

This process has been described in this Journal before, and we now take pleasure in reverting to it again, and laying before our readers some further testimonials, going to prove the great value of this invention in the economical production of gas of high illuminating power, from coals originally deficient in carbon.

The process consists essentially in finely pulverizing poor coal by machinery, and mixing it with a small percentage of petroleum oil, or its residuum. After the pulverized coal is prepared, it is mixed with the common coals in such proportions as may be desired, and distilled in the usual manner. Fifty tons of this prepared coal has lately been used at the Manhattan Gas Works in this city, with results giving great satisfaction. Coals which only gave 11 candle gas in the ordinary way, when mixed with 7½ per cent. of residuum gave a yield of 18½ candles, and a good quality of coke.

The value of oil as an enricher of coal gas by distilling, in connection with coals, is well known, but it has never been done in a practical manner until now. In this combination or compound, the oil seems to be decomposed more slowly, and the vapors unite more perfectly with the vapors of the coals, to produce a gas of just such quality as may be desired. The value of this invention will be appreciated by all engineers and gas men who are obliged to use in combination high priced foreign Cannel and other coals, to bring up the candle power of Westmoreland, Pennsylvania, and other American coals to the proper standard.

It is stated that coals costing $5 per ton laid down in New York can, by the addition of a small percentage of the *oil compound*, at an additional cost of $1 per ton, will yield a gas of 16 to 18 candle power.

The coal when prepared is hardly distinguishable from that which is unprepared. The oil being absorbed and taken up by the coal, it is therefore easily transported. Ordinarily it will doubtless be prepared at the coal mines, and furnished to gas companies like other coals.

A large coal company have the exclusive right to manufacture and supply the gas companies of London, England, and the cities of Manchester, Dublin, and other cities in Europe are using this prepared coal instead of Cannel, Boghead, etc, simply as a matter of economy.

We give herewith the certificates of Charles M. Cresson, the well-known gas chemist and engineer of Philadelphia, Pa; also of Charles C. Mowton, Esq., the efficient superintendent of the New York Gas Light Company.

We understand a company is being formed in this city to supply the Metropolitan and other gas companies with the "McKenzie Compound Gas Coal."

(Letter.) 417 WALNUT STREET,
PHILADELPHIA, April 23d 1869.

JOHN REID, Esq,

Dear Sir: I have examined and made trial of McKenzie's compound of pulverized coal and mineral oil for obtaining illuminating gas, and find it well adapted for the purpose.

The high price of Cannel and other materials formerly used for enriching the gas obtained from poor coals, has caused their discontinuance, and the standard of illuminating power has been lowered. The inflammability and danger of storing the mineral oils in the liquid form has hitherto prevented their adoption as sources of gas in large factories. Mr. McKenzie's patented process for mixing oil and coal fulfils all of the requisites of utility and safety; it destroys the easy ignition of the oil without materially increasing that of the coal; and the gas produced possesses that peculiar brilliancy and illuminating power only obtainable from petroleum oils and the richer Cannels.

The great advantages of coal and mineral oils combined, to the gas manufacturer, may be briefly summed up as follows; With good gas-making coals, it affords an easy and ready method of maintaining the illuminating power of the gas in very cold weather; it enables the use of six hours charges without detracting from the illuminating power; it allows of the rapid enrichment of the gas above the standard at such times, as a scanty supply may render it necessary to use any means to reduce the consumption of gas; and it enables the gas manufacturer to promptly correct the effect of variable quality, or of wet in the coals.

Coals that fall short in illuminating power may be made available for gas purposes. Semi-bituminous coals, producing a sufficient quantity of gas of low illuminating power, can also be made use of; the proximity of such coals to any given market will determine the policy of enriching them so as to compete with standard gas coals.

From experiment I have determined that the benefit derived from the use of a given percentage of mineral oil varies with the different qualities of coal.

Coal yielding a 14.17 candle gas, by the addition of one per cent of mineral oil, yielded a gas of 15.66 candle power, with an increase of volume equivalent to 10 feet of gas for each pound of oil added, and 1.40 candle power additional for each one per cent. of oil.

A semi-bituminous coal yielding 4.2 cubic feet of gas to the pound, and of eight candle power, yielded, for an addition of oil of one per cent., a gas of 10.25 candle power: and of two per cent. a gas of 12.10 candle power; and of three per cent. a year of 14.20 candle power.

The advantages possessed by gas works of thus increasing the source of supply of gas coals, and of insuring competition for their supply, evidence the great value of the invention of Mr. McKenzie, and I unhesitatingly recommend the process to their favorable consideration.

Respectfully,
(Signed.) CHARLES M. CRESSON.

(Copy). NEW YORK GAS WORKS,
June 10, 1869.

Dear sir: Having received a quantity of coal prepared according to the McKenzie process, I have used it for several consecutive days in a portion of our works; and I have now to report that the results were most satisfactory. I found that it carbonized equal to other gas coals, and that the coke was of good quality.

Yours truly,
(Signed) CHARLES C. MOWTON.
Suprintendent New York Gas Works.
Mr. John Reid, Everett House, N. Y.

FACTS ABOUT GAS FOR THE PEOPLE.

ECONOMICAL STANDARD GAS.—Gas can be produced of any desired illuminating power at the works, by the proper admixture of Cannel or other rich carbonaceous material with the Westmoreland or other caking coals ordinarily used; but consumers generally do not understand the difference between quantity and quality; at least do not appreciate only one item, namely, the cost per thousand cubic feet, without a thought of the amount of illumination a given amount of gas will yield. In London, England, two grades of gas are supplied, and the price is proportional to the quality of each.

For general use a high grade of gas would not be the best for various reasons. It would cost more in proportion than the increase in illumination gained, and the majority of consumers would never be able to utilize it properly, because it requires more judgment in managing the combustion at the burners, in order to get the full equivalent of light. The burners ordinarily used would need to be changed, and the pressure more nicely adjusted, so as to get the full value of the gas *in light*.

Everything considered, a gas of about 12 to 14 candle power; that is, gas which burned in the burner best adapted to it, consuming five feet of gas per hour, will give a light equal to 14 sperm candles, each consuming 120 grains per hour.

This grade of gas is not too rich to burn in the ordinary bat's-wing and fish-tail burners, and does not require an argand or other expensive burners. It is not liable to throw off carbon or smoke, and the light is more diffusive and agreeable to the eye, without the questionable (because wasteful) necessity of using some semi-transparent medium like cut glass and porcelain globes, shades, etc.

GAS FOR FUEL.—As an economical gas for heat-

inn and cooking, etc., this grade (14 candle) is best, inasmuch as gas for heating is becoming quite general in this country, owing to its convenience, cleanliness, and utility, as compared to coal or other solid fuel; it is therefore quite essential that the gas employed for lighting should also be of a quality that it can be used economically for heating. Taking into consideration the price for which 12 and 14 candle gas can be supplied, there is no question as to its being the proper standard for general use, both for heating and lighting.

Cooking by gas has many advantages; the heat may be maintained at any required temperature without constant attention. It can be lit instantly and extinguished as soon, and there is no slow combustion and waste of heat as is the case with coal fires when being extinguished. It makes neither smoke, smell, nor dust, and with proper apparatus to make the heat available it will cost less than coals.

The full equivalent of heat is obtained in the combustion of gas. In the combustion of coals and other solid fuels in the best arranged grates, stoves, etc., from 50 to 75 per cent. of the heat is lost. Why not use gas exclusively as fuel then in our cities, instead of continuing such extravagant wastefulness in the use of solid fuel?

Gas as a Motive Power.—The substitution of gas for steam to produce a power to move machinery and other purposes, is being much employed in the large cities of Europe; and is also being introduced here to some extent.

The Le Noir and Hugon Gas Engines are most popular. The gas mixed with a proper proportion of air is introduced into the cylinder and exploded; this acts upon the piston to give it motion, in the same manner as the steam in a steam cylinder. The gas engine has the merit of being free from the danger of explosion. There is no boiler, no furnace, but a simple cylinder and piston with the ordinary fly wheel. It is simple, cheap in construction, instantaneously brought into action and as quickly stopped, and there is no expense except when in actual motion. As this engine is likely to become quite popular, it may be well to state that 12 to 14 candle gas is the best and most economical for it, the same as for heating purposes.

In view of certain late important improvement in gas manufacture, it is not at all improbable that we shall soon employ it almost universally, not only for light but as a cheap and desirable substitute for coal or other solid fuel in heating, cooking, and metallurgical purposes, etc., and also as a simple harmless, and economical substitute for that unruly and destructive giant steam.

GAS LEGISLATION.

This is a topic evidently destined to occupy soon a large share of our columns. The peculiarities of the gas manufacture as now conducted place producer and consumer in antagonistic attitudes, and the foundations have been laid of feuds which must soon be fought out to the end. On the one hand we have powerful monied corporations, undertaking to dispense one of the prime necessaries of life, and usually entrusted with special privileges, and thus bound, at least according to public opinion, to fulfil a trust to the public; and on the other hand the community which has conferred this trust, but which, from the nature of the case, is to a great extent kept in the dark as to its fair and just fulfilment. What wonder that the seeds of dissension take root, and that communities which consider themselves aggrieved, begin to consider and propose the only means of attack (or defence) they possess in such cases, through legislative investigation and action.

Let us not be misunderstood. In these controversies this Journal is appropriately a neutral power; and should represent equally what we believe to be the best *ultimate* interests of producer and consumer alike; interests which are in reality inseparable.

We have already pointed out to our gas companies the obvious and only means by which they can avert the complications and expenses that here threaten them; namely, by jointly taking the matter into their own hands, or rather putting it into the hands of competent and disinterested scientific experts, who can determine the best means of production from given materials and of serving out to the public; and authoritatively communicate to the latter their best modes of consumption to obtain the most light for their money. (See our editorials in issue of March 16th.)

We are sorry to add that with the honorable exception of the Manhattan Gas Light Company, of New York, we have heard of little or no response to these suggestions.

Some points in the history of the investigation now pending before the Legislature of New York, we have already given, though in the rather unreliable form of extracts from newspaper reports. We shall soon be prepared to lay before our readers authentic accounts from official sources. In the mean time we have before us all the documents relating to the similar investigation, up to date, of the Massachusetts Legislature, which is still in session, and may yet take some decisive action before adjournment. These were received too late for the present issue, but will be fully reproduced in the next.

H. W.

Sellar's Cement.—This remarkable cement is used for repairing broken fire-clay retorts, without removal from their beds. Also for patching or piecing out retorts, stopping cracks in both fire-clay and cast iron retorts, making joints in ascension pipes, cementing mouth-pieces, coating and filling the pores of new retorts, etc., etc. It is an English invention, which has gained a great reputation in Europe, and will doubtless become very popular here with our gas engineers and others.

As an evidence of its merit it is only necessary to say that Messrs. Herring & Floyd, 742 to 746 Greenwich street, New York, have secured the sole agency of it for the United States, of whom further information may be obtained. See advertisement in another column.

Our Chemical Repertory.—Our readers may not be dissatisfied to learn that Professor Wurtz proposes actively to resume, in our next, his chemical contributions, which for some months past have been interrupted by a press of professional duties.

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CLEGG—Treatise on the Manufacture of Coal Gas, 5th edition, enlarged. 4to., cloth. Price, $10.50.

COLBURN—The Gas Works of London, 12mo., boards. Price, 75 cents.

CROLL—Report of the Proceedings on the Arbitration with the Great Central Gas Consumers' Company, 8vo., cloth. Price, $2.50.

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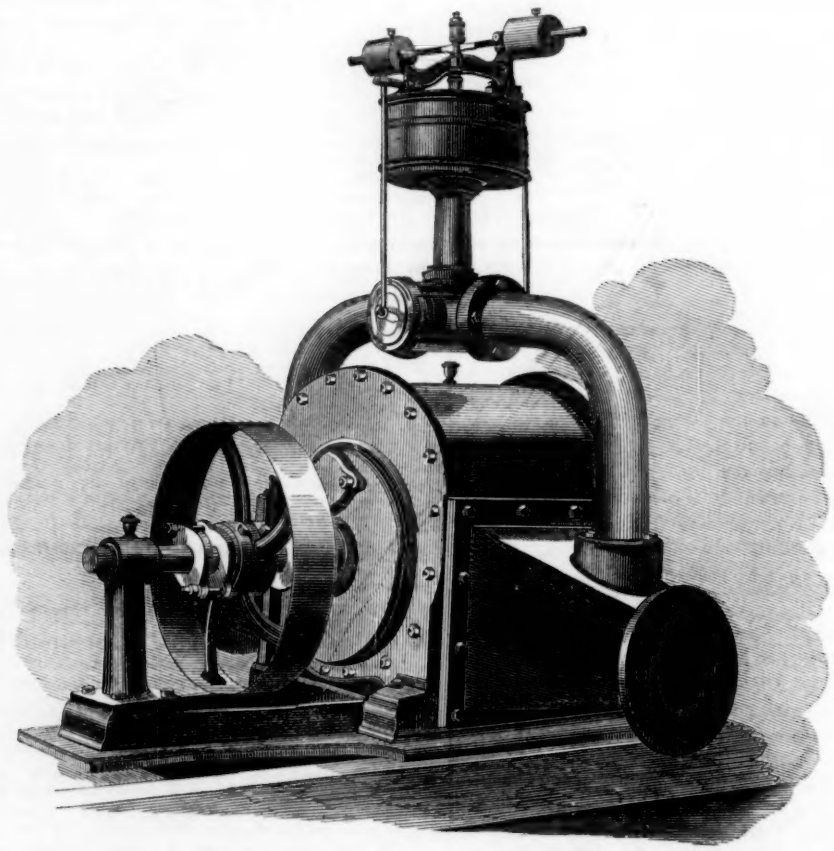

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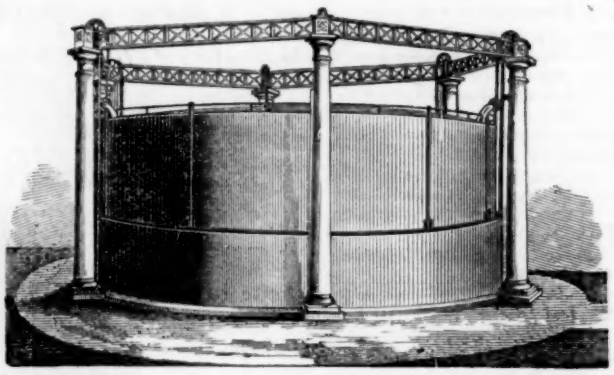

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Fig. 2 represents wedge and one-half of gate.

Fig. 3, a section through body, gate and wedge, intended for larger sizes of water valves required to bear heavy pressure either side.

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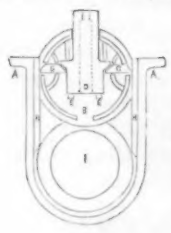

FIG. 3. FIG. 2.

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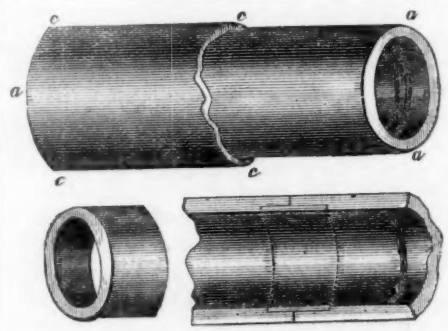

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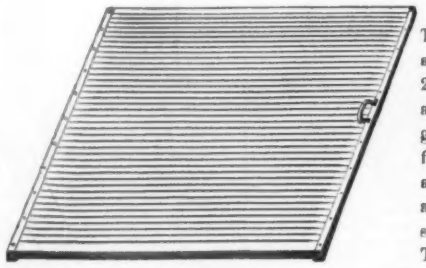

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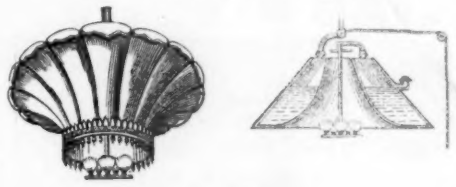

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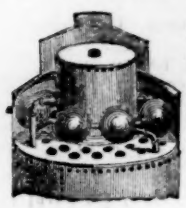

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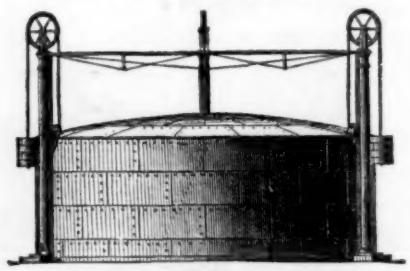

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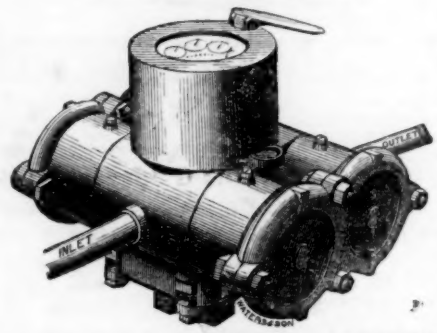

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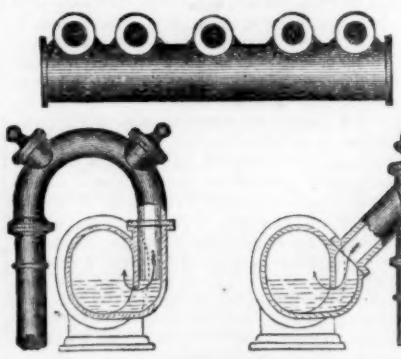

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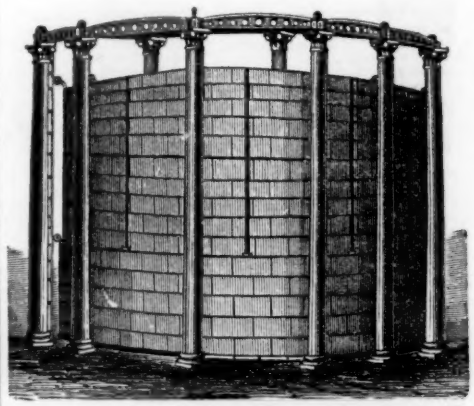

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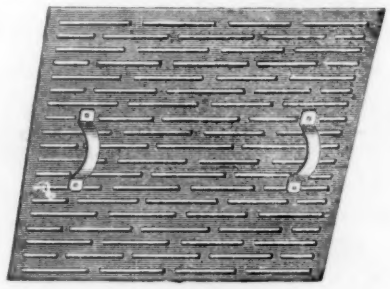

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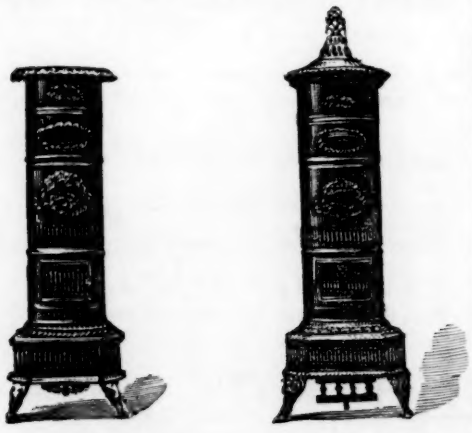

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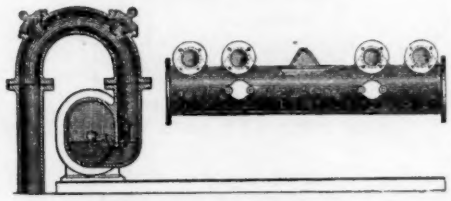

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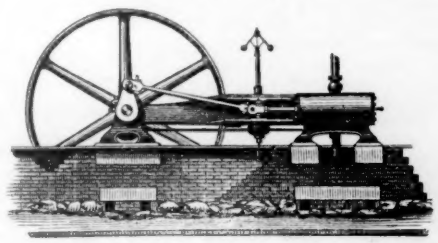

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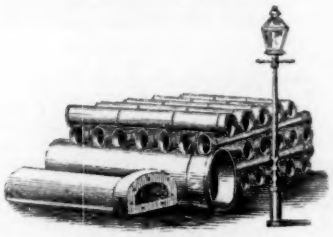

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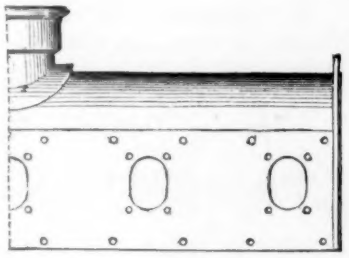

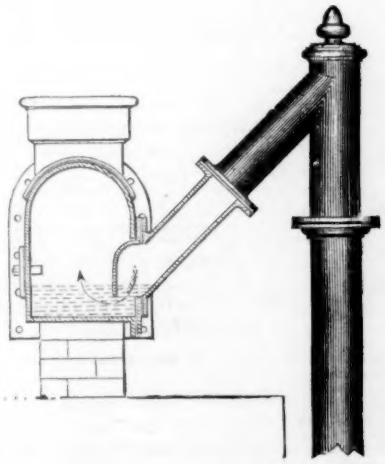

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STEPHEN MORRIS, THOS. T. TASKER, JR., STEPHEN P. M. TASKER, HENRY G. MORRIS.

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GAS-BURNERS, APPARATUS ETC.

Arnold's Metallic Gas Trays—T. G. Arnold, 334 and 336 West 21st street, N. Y. 6
American Meter Company, 512 West 22d street, New York 8
Automatic Gas Purifier—State Rights for sale—Wm. C. Turnbull, care of T. C. Babcock, 59 Broadway, or office of the AMERICAN GAS-LIGHT JOURNAL 7
American Self Gas Lighting Torch and Improved Key—J. W. Barlett, 569 Broadway, N. Y. 3
Builder of Gas Works, Apparatus, Etc.—P. P. Deily, 39 Laurel street, Philadelphia 2
Cambridge Gas Stoves, Ranges, &c.—Gas Light Journal Offices, 8
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B. Kreisher, Clay Retorts, Etc., 58 Goerck street, New York 5
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Sodium Amalgam &c.—Prof. Wurtz, 26 Pine st., New York. 7
School of Mines, Columbia College, East 49th st. 7

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Scientific Books—D. Van Nostraud, 23 Murray street, N. Y. 2
Smedberg's "Synopsis of Gas-Lighting" 7
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The Newburgh Orrel Coal Company—Chas. W. Hays, Agent in New York, Trinity Building, 111 B'way, Room 7 2
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